* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]At the center of the fluorescent substance in an electric field, this invention collides and an acceleration electron using voltage excitation type EL (Electronic Luminescence) element which emits light (electroluminescence) The light source for back lights of liquid crystal displays, such as a portable telephone or a wrist watch, It is related with a lamination type EL element display device and a manufacturing method for the same for using it for an ornament, a wall tapestry, etc. which emit light and display an ornament pattern etc.
[0002]
[Description of the Prior Art]Conventionally, this kind of EL element is a structure which piles up and puts a ZnS fluorescent substance with a light transmittance state glass electrode and a metallic foil, for example.
The electric field about 10^4 (V/cm) is given, and is made to emit light.
In such luminescence, if a little Mn is added to ZnS (zinc sulfide), light will be emitted in a yellow-orange color, and if a little Tb is added to ZnS, light will be emitted green. The fluorescent substance which used the organic matter to addition of an inorganic substance is also developed in recent years.
[0003]In an EL element, luminescence from a section is not obtained with the structure piled up and put in a flat surface. For this reason, as an electrode to put, light transmittance state materials, such as indium tin oxide (Indium Tin Oxide and henceforth "ITO"), are used, for example. This IT0 material is paste state with easy handling in an ordinary temperature grade. It is used as a sheet shaped light transmittance state electrode material broadly formed by the vacuum evaporation technique on sheet materials, such as polyethylene terephthalate (PT).

[0004]If such an EL element forms an electrode and impresses voltage on the EL layer side of another side after it forms an EL layer on a light transmittance state electrode material, uniform luminescence will be obtained from the light transmittance state electrode material side. This luminescence is used as a light source for back lights of the liquid crystal display of a portable telephone or a wrist watch. If such an EL element is arranged, for example so that it may become a desired pattern, and prescribed voltage is impressed between an ITO electrode (cathode) and another electrode (anode) on an EL layer, a desired pattern will emit light and will be displayed.

[0005]Drawing 5 is a sectional view showing the structure of the conventional EL element, and drawing 6 is an appearance perspective view for explaining the manufacturing process of the conventional EL element. Drawing 7 is a flow chart in the manufacturing process of the EL element shown in drawing 5.

[0006]The sectional view shown in drawing 5 shows the section structure concerning the B-B line in drawing 6 (d).

[0007]In drawing 5, drawing 6, and drawing 7, ITO film 2 used as a light transmittance state electrode is first vapor-deposited to one approximately whole area of the substrate (PET) 1 which penetrates light (drawing 6 (a)). Next, EL layer 3 is formed in two or more prescribed positions (two or more positions to which the lighting is carried out effectively in the case of a back light source) on ITO film 2. Spreading of screen-stencil performs this formation. Multiple-times operation of this spreading is carried out so that predetermined thickness may be obtained (drawing 6 (b)).

[0008]Two or more insulator layers 4 are applied so that it may become predetermined thickness by screen-stencil, so that each of two or more EL layers 3 may be covered. For example, multiple times and its spreading are carried out (drawing 6 (c)). After this, the resist which is not illustrated by the same thickness as abbreviation is applied to the circumference of two or more insulator layers 4 by screen-stencil. For example, multiple-times operation of this spreading is carried out so that predetermined thickness may be obtained.

[0009]And the back plate 5 using carbon paste or silver paste is applied by screen-stencil to the approximately whole area of the substrate (PET) 1 so that each of two or more insulator layers 4 may be contacted (drawing 6 (d)). The protective film 6 shown in drawing 5 is formed on this back plate 5. Voltage is impressed to ITO film 2 and the back plate 5, and all the EL layers 3 emit light, for example, it becomes a back light source of a liquid crystal display (LCD), a wrist watch, etc.

[0010]Thus, the conventional EL element is formed in the back side of the charge of a light transmittance state support material used as a light-emitting surface by spreading of screen-stencil of a light transmittance state electrode (ITO), a luminous layer, a dielectric layer, a back material layer, and a regist layer. For this reason, structure is complicated, and material is

expensive, and cost increases, and degradation with the passage of time is large.
[0011]The publication of registered utility model applications No. 3066629 "circuit board" can be mentioned, for example as an example of an improvement over the complexity of such a structure, the quantity value of material, or degradation with the passage of time. As that EL element, the circuit board indicated here provides the electrode of a couple as a flat surface on the base of a printed circuit board, forms a dielectric layer on the electrode of one of these, or both, and forms the illuminant layer and the light transmittance state sealing layer on it.
[0012]The electrode of the couple in this case is the structure of the electrode by plane configuration. That is, it is the structure of the electrode of the shape of a ctenidium arranged so that the electrode of another side may be inserted in one identical shape inter-electrode of two or more. The electrode of this couple is the structure of a whorl electrode where adjacent electrodes have arranged two electrodes to the parallel state which becomes an antipole.
[0013]
[Problem(s) to be Solved by the Invention]Thus, in the above-mentioned conventional example, since the ITO film of an expensive light transmittance state electrode is formed on one approximately whole area of a substrate, cost increases, and a wide range use is not turned to. Since it was the structure where a light-emitting surface was vertically formed to the direction of vision, there was a fault that substantial luminous efficiency was bad.
[0014]While this invention solves SUBJECT in such a Prior art, the amount of the ITO material used which is a comparatively expensive light transmittance state electrode becomes the minimum, the cost is reduced and use of a wide range use is attained, Since it becomes possible in respect of both while a light-emitting surface is parallel to the direction of vision or, it aims at offer of an EL element display device whose flexibility of the composition improved, and a manufacturing method for the same.
[0015]
[Means for Solving the Problem]The 1st electrode by which this invention was formed on a substrate and said substrate in order to attain an aforementioned problem, A luminous layer by electroluminescence material on said 1st electrode formed in part at least, It counters with said luminous layer, and has said 1st electrode and the 2nd electrode formed in a deenergization state, and a lamination type EL element display device, wherein said at least one said substrate, said 1st electrode, or 2nd electrode side is formed with light transmittance state material is provided.
[0016]This lamination type EL element display device isolates said luminous layer and said 2nd electrode further, and an insulating layer which insulates said 1st electrode and said 2nd electrode is formed. This insulating layer is usually formed with a dielectric. And structure where luminescence can be viewed by both sides of a luminous layer can be provided by forming both sides of said substrate, said 1st electrode and said 2nd electrode, and said

insulating layer with light transmittance state material.

[0017]The 1st conductivity terminal area for light emission voltage impression by which said a part of 1st electrode is further connected on a substrate, Having the 2nd conductivity terminal area for light emission voltage impression by which said a part of 2nd electrode is connected, these constitute a circuit pattern formed screen-stenciling high conductivity metal on said substrate, or by etching high conductivity metal. Here, face shape of said 1st electrode is formed so that it may be substantially in agreement with it of said luminous layer. Indium tin oxide (ITO) is used for said 1st electrode that has this light transmittance state, for example. Said luminous layer is ZnS and high conductivity metal which forms said 2nd electrode is Cu or Ag.

[0018]To this lamination type EL element display device, a protective layer is formed on said 2nd electrode, and use durability is raised. A luminous layer used in this invention is good also as a mixed material of electroluminescence material and a dielectric material.

[0019]This lamination type EL element display device forms a light-emitting part constituted by said substrate, said 1st electrode, said luminous layer, and said insulating layer and said 2nd electrode so that a predetermined pattern may be displayed on said substrate. Said pattern can be made to make it display except for a light-emitting part by printing including color here. It becomes possible by making said substrate deformable to make an applicable field of this device expand by leaps and bounds.

[0020]The 1st process of forming the 1st electrode with light transmittance state conductivity by screen-stencil on a substrate with which this application penetrates light further, The 2nd process of laminating and forming a luminous layer on said 1st electrode according to electroluminescence material in part at least by screen-stencil, The 3rd process of countering said luminous layer in a wrap insulating layer at said luminous layer the 3rd process formed by screen-stencil, and on said insulating layer, and forming the 1st electrode and the 2nd electrode of a deenergization state by screen-stencil, A manufacturing method of a lamination type EL element display device which said 1st process being consisted of by each process of the 4th process for drying a formation material in the 4th process is provided.

[0021]On said substrate, the 1st conductivity terminal area for light emission voltage impression by which said a part of 1st electrode is connected is formed by screen-stencil here, By screen-stencil, the 2nd conductivity terminal area for light emission voltage impression by which said a part of 2nd electrode is connected is formed, and further, Said insulating layer is light transmittance state material with conductivity, the light transmittance state material concerned is formed by screen-stencil, and a dielectric layer is formed in said luminous layer and inter-electrode [said / 2nd] by screen-stencil.

[0022]By such composition, this lamination type EL element display device concerning this invention reduces the amount of ITO material used which is an expensive light transmittance

state electrode, and reduction of a manufacturing cost of it is attained, and it becomes usable to a wide range use. And by the rear surface side (both sides of a luminous layer) of an EL element display, can view the luminescence and it becomes structure, Luminescence on the side front (one field of a luminous layer) or luminescence of display both sides can be chosen now, and it becomes possible to raise flexibility of composition of apparatus incorporating the device concerned.

[0023]

[Embodiment of the Invention]Hereafter, the details of the embodiment of a lamination type EL element display device of this invention and a manufacturing method for the same are explained, referring to drawings.

[0024]Drawing 1 is a sectional view showing the structure in operation carrying of the EL element of this invention. Drawing 2 is an appearance perspective view for explaining the manufacturing process of the EL element shown in drawing 1, and drawing 3 is a flow chart in the manufacturing process of the EL element corresponding to drawing 1. Here, the sectional view shown in drawing 1 shows the section structure concerning the B-B line in drawing 2 (e).

[0025]In drawing 1, drawing 2, and drawing 3, an EL element is a laminated structure and this example shows that manufacturing method.

[0026]First, Ag (silver) paste (or carbon paste) is applied by screen-stencil, and two or more wiring terminal areas 11a and 11b which show drawing 3 which makes two parallel poles with a lot one approximately whole area of the substrate (PET) 10 which penetrates light are formed (process C1 in drawing 2 (a) and drawing 3). Two or more wiring terminal areas 11a and 11b may be stationed with the circuit pattern which formed Cu in a printed circuit board by etching. The liquid crystal display for lighting is arranged on another side of this substrate 10.

[0027]Next, two or more ITO films 12 shown in drawing 3 which is a circular light transmittance state electrode which some lobes connect are applied and formed in the wiring terminal area 11a and substrate 10 top between 11b, and the wiring terminal area 11a by screen-stencil. Two or more ITO films 12 are arranged in two or more positions to which the lighting is carried out effectively, for example, when the device concerned is a back light source (process C2 in drawing 2 (b) and drawing 3).

[0028]Two or more EL layers 13 shown in drawing 3 of a circular area of two or more ITO films 12 upwards a little smaller respectively than the area of this ITO film 12 are formed. EL layer 13 is ZnS (activity material content of Mn etc.) etc. Two or more of these EL layers 13 have screen-stencil, and apply and form it. For example, multiple times and its spreading are carried out so that it may become predetermined thickness (process C3 in drawing 2 (c) and drawing 3).

[0029]Next, two or more insulator layers 14 shown in drawing 3 are applied by screen-stencil so that each circular portion in two or more EL layer 13 and two or more ITO films 12 may be

covered. For example, multiple times and its spreading are carried out so that it may become predetermined thickness (process C4 in drawing 2 (d) and drawing 3).

[0030]each in two or more insulator layers 14 -- the back plate 16 is formed upwards. This back plate 16 is shape shown in band-like and multiple drawing 3 which is covered so that the circular portion of EL layer 13 may be included at least, and is extended and connected to the wiring terminal area 11b, and is applied and formed with screen-stencil (process C5 in drawing 2 (e) drawing 3). This back plate 16 applies the paste material of Cu or Ag by screen-stencil.

[0031]Next, the protective film which is not illustrated in the part 3 is formed on the back plate 16. After this, it becomes a drying process.

[0032]The EL element produced by such a laminated structure impresses predetermined frequency and voltage to the wiring terminal areas 11a and 11b through a DC to DC converter, for example. By this, all the EL layers 13 can use it also for the back light source of that the front face emits light towards the visual direction, a next door (LCD), for example, a liquid crystal display, a wrist watch, etc.

[0033]Next, spreading by screen-stencil is explained. Two or more ITO films 12, EL layers 13, insulator layers 14, etc. are formed by spreading by screen-stencil, respectively. The area by this spreading and its thickness are determined by the opening formed in the screen mask. In this case, multiple times are applied and it forms in predetermined thickness.

[0034]When this application portion (light-emitting part) is N number, it becomes this more than N twice as many electric capacity as this. When the electric capacity of each light-emitting part differs, the charge quantity within the charging time by voltage impressing or fixed time will be different, and the amount of luminescent light and luminescence speed (build up time of luminescence) in each light-emitting part of the will change.

[0035]For example, although electric capacity seldom produces the difference of the light quantity in each light-emitting part from 7000 pF in 10kpF, as for the case of 10kpF to 15kpF, light quantity (illumination/Lux) falls about to 2/3.

[0036]When wide range and uniform illumination is required like the back light source of a liquid crystal display (LCD) from these (i.e., when application portions (light-emitting part) are many N numbers), the area by spreading and its thickness are managed so that the error of electric capacity may not arise. It becomes possible to change the luminescence standup speed in the cases, such as blink luminescence, by forming the light-emitting part with which electric capacity differs intentionally conversely.

[0037]In the EL element of such a laminated structure, two or more ITO films 12 which are light transmittance state electrodes are formed only among the wiring terminal areas 11a and 11b. And two or more ITO films 12 are the circular shape of a little larger area than EL layer 13. Therefore, the ITO material which is an expensive light transmittance state electrode needs to cease to apply all over the substrate 10, for example, the amount used becomes the minimum,

and cost reduction becomes possible. This becomes usable to a wide range use.
[0038]Next, the modification of the EL element shown in drawing 1 is explained.
[0039]If the insulator layer 14 uses the material of light transmittance state conductivity as the back plate 16 with material with light transmittance state conductivity, the luminescence can be viewed from the both-sides side of a luminous layer (EL layer 13). Therefore, luminescence on only the above mentioned side front (on the other hand field [Luminous layer]) and luminescence of luminous layer both sides can be chosen now, and the flexibility of the composition (design) of the apparatus incorporating the device concerned improves.
[0040]The dielectric layer which has arranged the dielectric material (for example, material provided with the light transmittance state) for adjusting electric capacity may be formed between EL layer 13 and the back plate 16. The mixed material of electroluminescence material and a dielectric material may be used for this dielectric layer.
[0041]Next, the application of the EL element shown in drawing 1 is explained.
[0042]Drawing 4 is a figure showing the composition of the application using the EL element shown in drawing 1.
[0043]Drawing 4 (a) is a front view showing front composition, and drawing 4 (b) is a sectional view showing the important section composition concerning the C-C line in drawing 4 (a).
[0044]This example is an application of the christmas tree using the EL element of the laminated structure which had and explained drawing 1 - drawing 3. In drawing 4 (a), EL elements 20 and 21 and 22 -- which emit light by asterisk, a round mark, etc. are arranged at the front face as a circular ornament so that the shape of a christmas tree may be suited.
[0045]As shown in drawing 4 (b), the electronic circuit board 24 for [of EL elements 20 and 21 and 22 --] driving and controlling luminescence is formed in the rear face with EL elements 20 and 21 and the button cell 23 used as a power supply of 22 --. The electronic circuit board 24 is constituted by the IC drivers etc. which are controlled preferably [the light-emitting display of a christmas tree which set up arbitrarily the switching DC to DC converter which is a driving source, and emission order and emission time].
[0046]So that clearly from the above explanation the lamination type EL element display device of this invention, A substrate, the 1st electrode formed on said substrate, and the luminous layer by the electroluminescence material on said 1st electrode formed in part at least, It counters with said luminous layer, and has said 1st electrode and the 2nd electrode formed in the deenergization state, and said at least one said substrate, said 1st electrode, or 2nd electrode side is formed with light transmittance state material. By this stopping the amount of the ITO material used which is an expensive light transmittance state electrode to the minimum, cost was reduced and use for a wide range use was enabled.
[0047]In this invention, since it was formed in respect of both while the light-emitting surface was suitable in the visual direction or, the lamination type EL element display with visual high

luminous efficiency whose flexibility of composition is very high has been realized.

[Translation done.]